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US-CL-CURRENT: 725/115, 709/231 , 710/14 , 710/52 , 711/118 ,  
725/119  
 , 725/88 , 725/92 , 725/94 , 725/97

A data storage system includes a mass storage unit storing a data entity, such as a digital representation of a video presentation, that is partitioned into a plurality  $N$  of temporally-ordered segments. A data buffer is bidirectionally coupled to the mass storage unit for storing up to  $M$  of the temporally-ordered segments, wherein  $M$  is less than  $N$ . The data buffer has an output for outputting stored ones of the temporally-ordered segments. The data storage system further includes a data buffer manager for scheduling transfers of individual ones of the temporally-ordered segments between the mass storage unit and the data buffer. The data buffer manager schedules the transfers in accordance with at least a predicted time that an individual one of the temporally-ordered segments will be required to be output from the data buffer. When employed with a media streamer (10) distributed data buffer management techniques are employed for selecting blocks to be retained in a buffer

memory,  
either in a storage node (16, 17) or in a communication node (14).  
These  
techniques rely on the predictable nature of the video data stream, and  
thus  
are enabled to predict the future requirements for a given one of the  
data  
blocks.

12 Claims, 26 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 14

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Brief Summary Text - BSTX (11):

The playing of movies and video is today accomplished with rather old  
technology. The primary storage media is analog tape, such as VHS  
recorders/players, and extends up to the very high quality and very  
expensive  
D1 VTR's used by television studios and broadcasters. There are many  
problems  
with this technology. A few such problems include: the manual labor  
required  
to load the tapes, the wear and tear on the mechanical units, tape  
head, and  
the tape itself, and also the expense. One significant limitation that  
troubles Broadcast Stations is that the VTRs can only perform one  
function at a  
time, sequentially. Each tape unit costs from \$75,000 to \$150,000.

Detailed Description Text - DETX (32):

RAID REDUNDANT ARRAY of INEXPENSIVE DISKS: A storage arrangement  
that uses  
several magnetic or optical disks working in tandem to increase  
bandwidth  
output and to provide redundant backup.

Detailed Description Text - DETX (57):

In general, a storage node includes a mass storage unit (or an  
interface to  
a mass storage unit) and a capability to locally buffer data read from  
or to be  
written to the mass storage unit. The storage node may include  
sequential  
access mass storage in the form of one or more tape drives and/or disk  
drives,  
and may include random access storage, such as one or more disk drives  
accessed

in a random access fashion and/or semiconductor memory.

Detailed Description Text - DETX (96):

A second advantage of combining hierarchical tape storage to any video system is that it provides rapid backup to any movie that is stored on disk, in the event that a disk becomes inoperative. A typical system will maintain a "spare" disk such that if one disk unit fails, then movies can be reloaded from tape. This would typically be combined with a RAID or a RAID-like system.

Detailed Description Text - DETX (400):

The buffer operation is managed by the video adapter's controller 226, placing the N bytes of data in the next available buffer space starting at address zero of that buffer. Controller 226 keeps track of the length of data in each buffer and if that data has been "played" or not. Whenever sufficient buffer space is free, the card accepts the next WRITE command and DMA's the data into that buffer. If not enough buffer space is free to accept the full data block (typically a Slow Play or Pause condition), the WRITE is not accepted and a buffer full return code is returned.